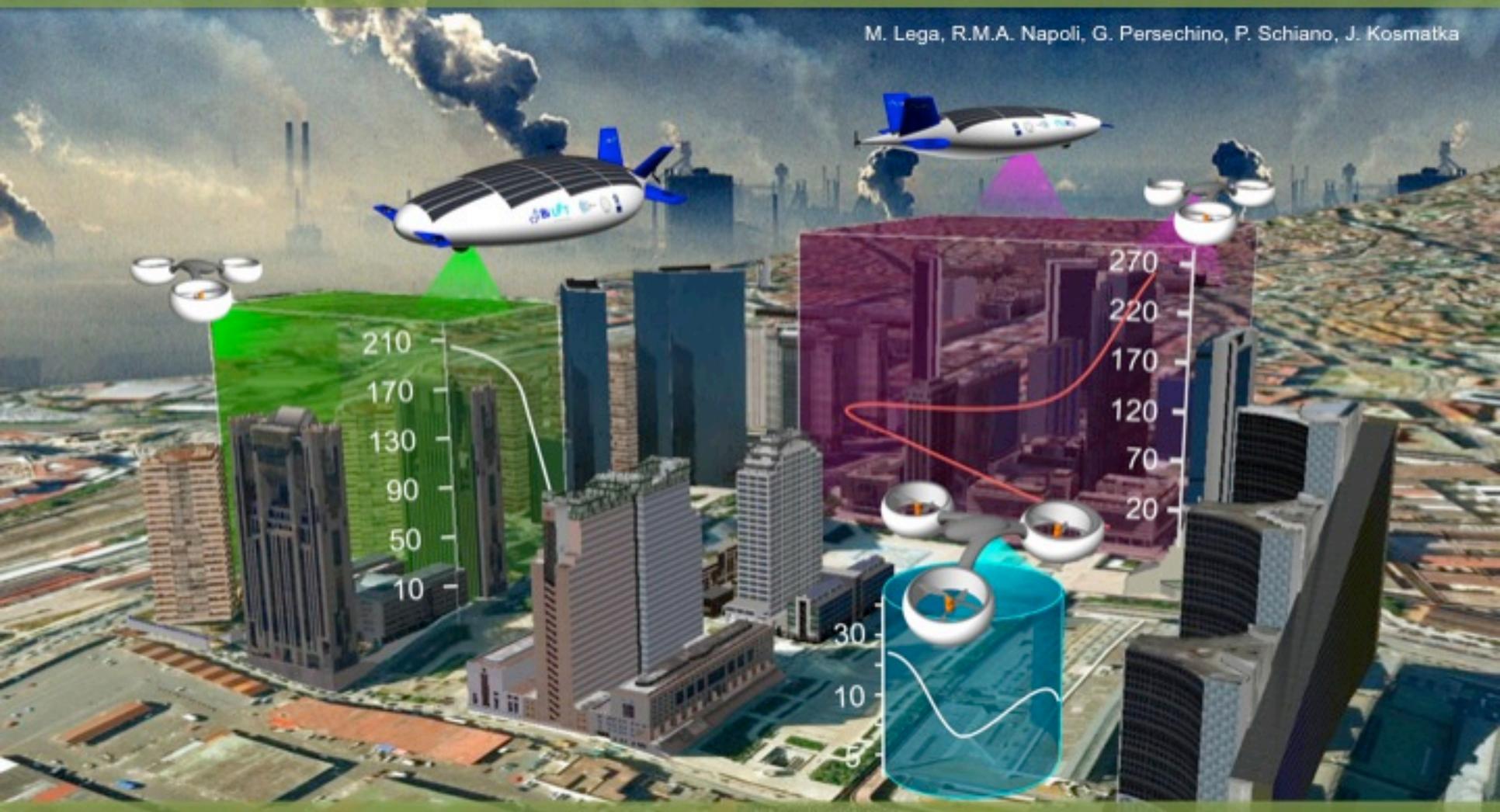




Measurements of the Urban and Suburban CO2 Vertical Profile with an Airborne Electro-Optical Device

M. Lega, R.M.A. Napoli, G. Persechino, P. Schiano, J. Kosmatka





Contents

- 3D Monitoring
- Air pollution monitoring: case study history
- Sensors technology
- Aerial Platforms
- EMPA project
- BiLift – Advanced Hybrid Airship
- Advanced MAV Multirotor
- 3D Air Quality Monitoring: future perspective
- New case study: Business District of Naples



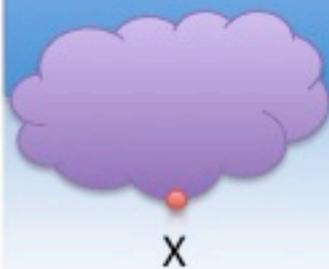


3D Monitoring



Where monitoring?

Spot



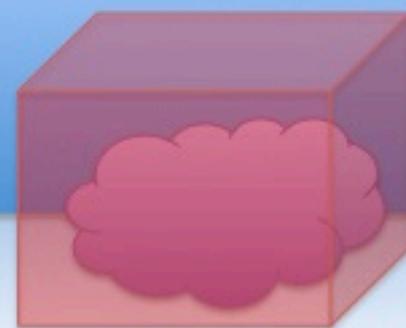
X

Area



X,Y

Volume

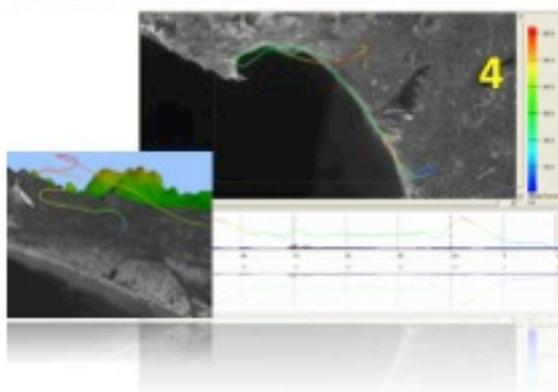
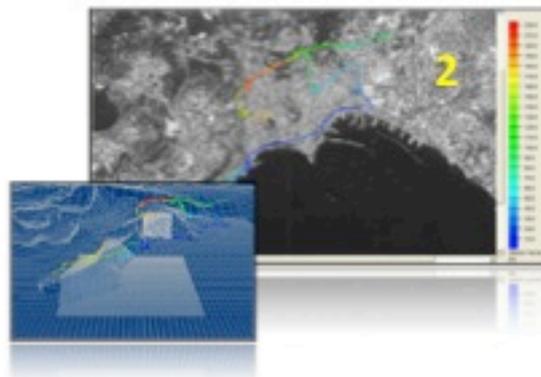


X,Y,Z





Air pollution monitoring: case study history



- 1) "Fixed point"
- 2) "Dynamic", short range by ground vehicle
- 3) "Dynamic", long range by ground vehicle

- 4) "Dynamic", long range by aerial platform
- 5) "Dynamic", vertical profile by aerial platform
- 6) "Dynamic", vertical profile by tethered balloon



Sensors technology



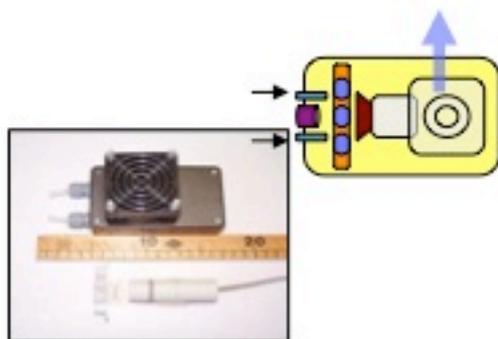
IR Camera



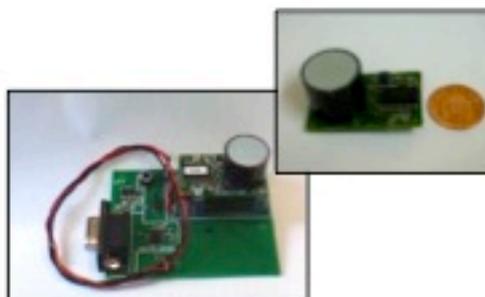
Thick film solid state sensor



Quartz crystal microbalance



Biosensor



Led NDIR CO2 sensor



Air sampler



Aerial Platforms



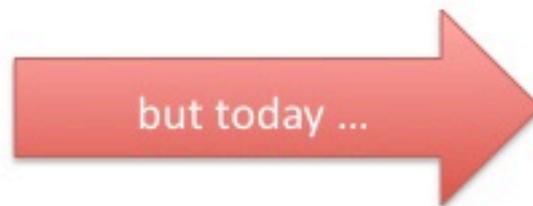
ULM



T. Balloon



Blimp





EMPA project

Environmental Monitoring Performed by Advanced Sensors And LTA Platforms Supporting Urban And Suburban Early Warning Actions

Team

CIRA (Italy)

Italian Aerospace Research Center

PARTHENOPE (Italy)

University of Naples - Department of Environmental Sciences

CNR-IBP (Italy)

Italian National Research Council - Institute of Biochemistry of the Proteins

UCSD (USA)

University of California, San Diego - Department of Structural Engineering

UMD (USA)

University of Maryland - Department of Atmospheric and Oceanic Science





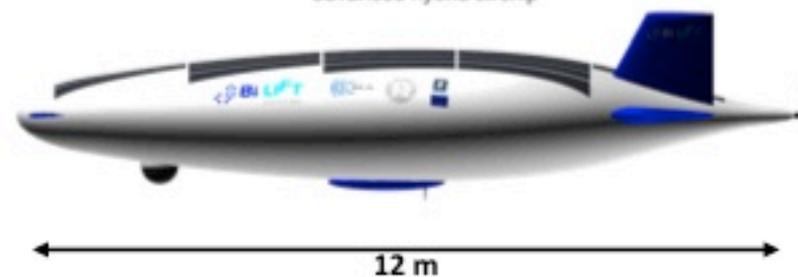
BiLift – Advanced Hybrid Airship

SPECIFICATIONS

Length	12 m
Width	4.5 m (Dmax) – 2.20 m (Dmin)
Max Speed	50 Km/h
Payload	20 kg
Max weight (w/o helium)	60 Kg
Endurance	> 4 hours
Max. Altitude	1000 m
Control	RC/RPV/UAV

Plus:

- "Zero" emissions
- High maneuverability at low speed
- Easy handling
- Vertical take-off and landing
- Low cost management





BiLift – Advanced Hybrid Airship

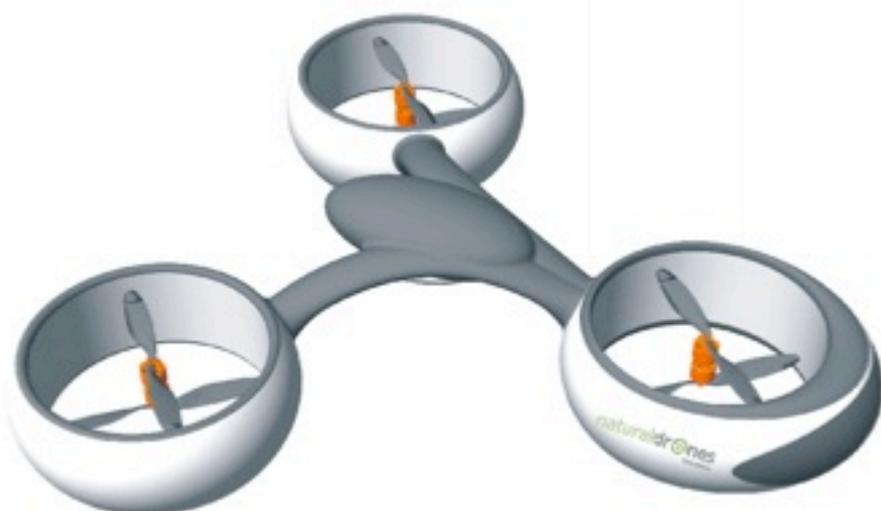


BiLift – first flying prototype



Advanced MAV Multirotor

naturaldrones
flying systems



SPECIFICATIONS

Length - Width	1 m - 1 m
Max Speed	50 Km/h
Payload	1 kg
Endurance	20 - 30 min
Max. Altitude	300 - 500 m
Datalink range	2 km
Control	RC/RPV/UAV

Plus:

- Autonomous flight (by waypoint)
- "Zero" emissions
- High maneuverability
- Easy handling
- Vertical take-off and landing
- Low cost management
- Safe (special frame + flight termination system: elect. control and parachute)





Advanced MAV Multirotor



Mold model and first fiberglass frame



Advanced MAV Multirotor

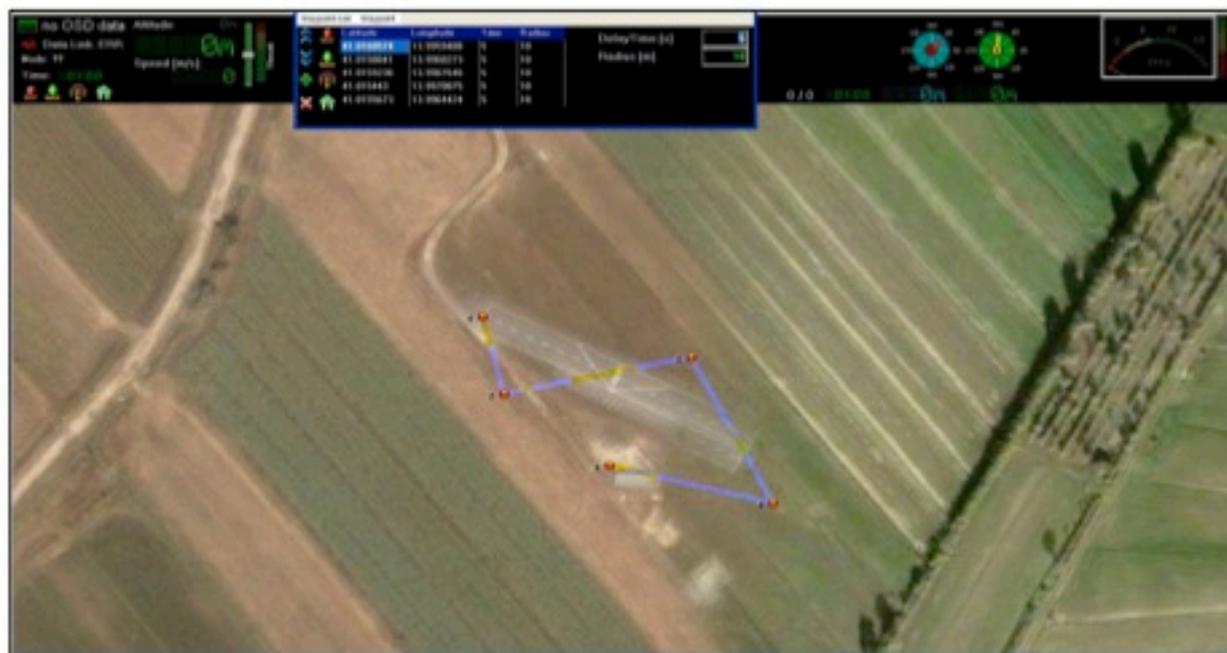


First flying prototype





Advanced MAV Multirotor



Example of virtual cockpit
(realtime flight data + map + way point +....)



3D flight path





University of Naples Parthenope



Italian Aerospace Research Center



University of California - San Diego

Advanced MAV Multirotor



Video 3



Air Quality Forecasting, Mapping, and Monitoring Communicating Air Quality



NAQC 2010 - March 15-18, 2010 - Raleigh, NC (USA)

Speaker: M. Lega



3D Air Quality Monitoring: future perspective





New case study: Business District of Naples



Aerial view



Standard picture



Satellite view and 3D building overlap





New case study: Business District of Naples

Patent

Title: Air pollutants monitoring by a continuous process, in real time and at different altitudes.

Inventors: M. Lega – R. M. A. Napoli

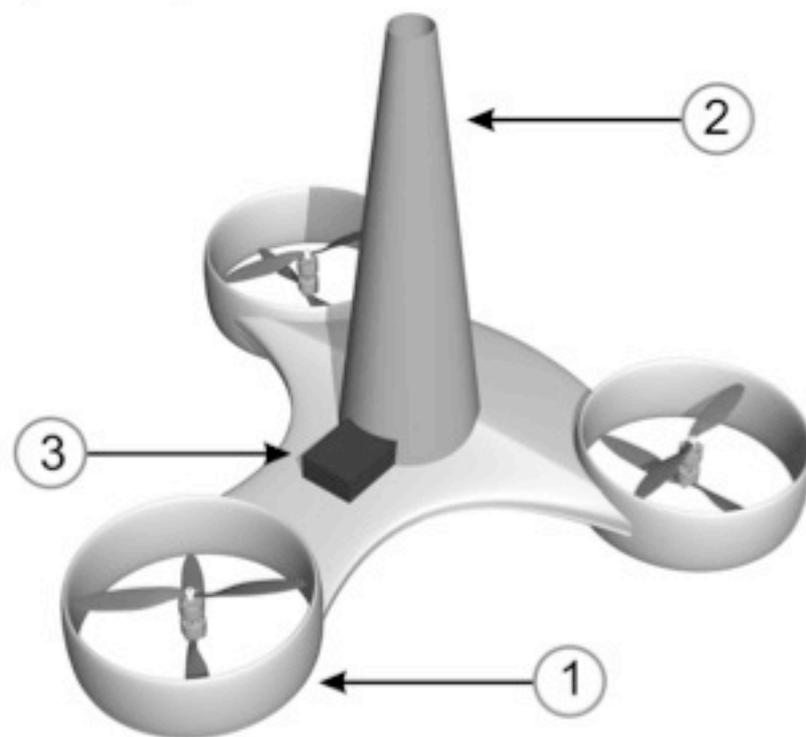
Plus

- uses a fluid dynamics probe that allows to analyze air flux without any perturbation by the lift and the propulsion system of the aerial multirotors platform;

- uses an aerial multirotors platform with an electrical propulsion system, so any alterations of monitored scenario due to pollutant added by on board combustion systems (typically used by gas engine) are avoided;

- allows to see in real time, on the ground station, the 3D position of the aerial multirotors platform;

- allows to pilot the platform through sequences of preset points of measuring/stationing that will constitute a spatial sampling grid of the monitoring scenario linked to the data collected by the on board sensor .





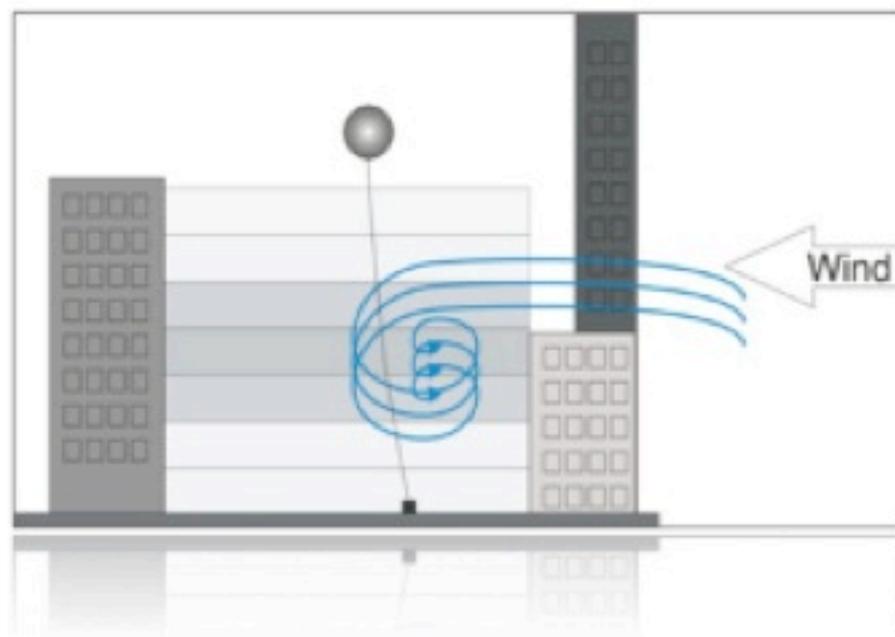
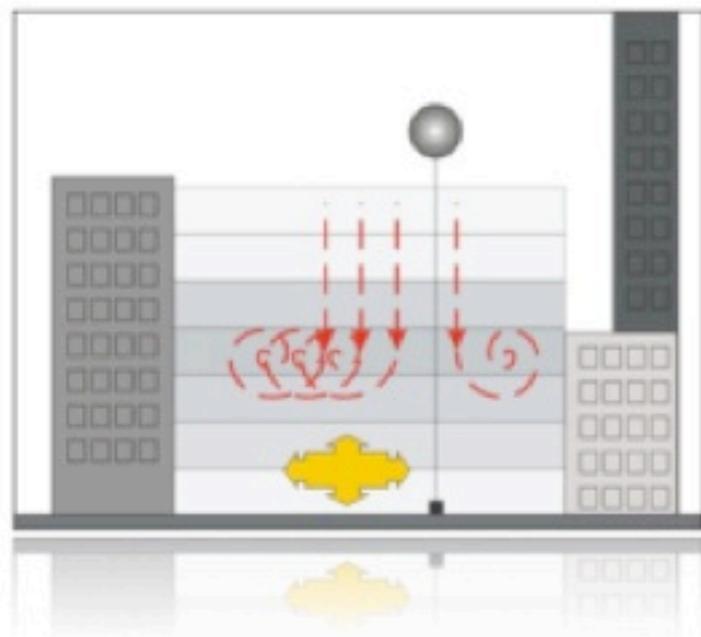
New case study: Business District of Naples

Location of first measurements spots





New case study: Business District of Naples



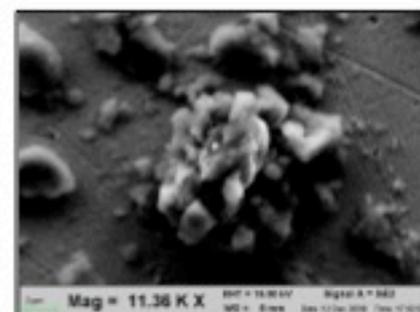
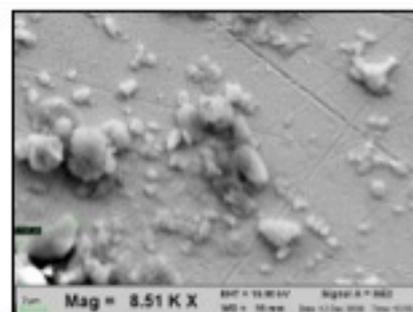
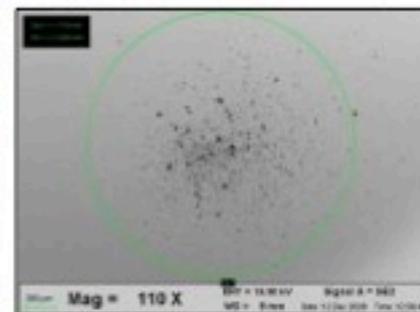
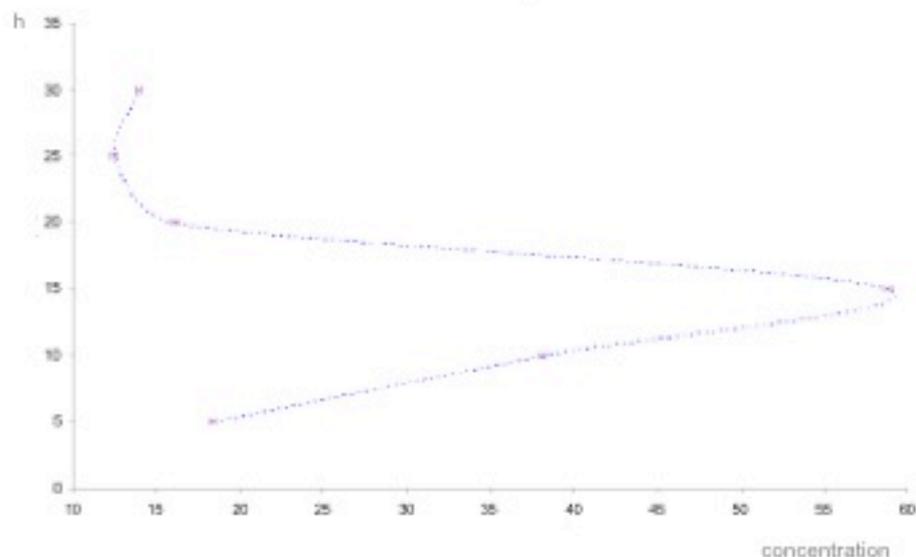
Urban canyon, floating volume and downwash





New case study: Business District of Naples

PM vertical profiles



with contribution of **novatech**



Air Quality Forecasting, Mapping, and Monitoring Communicating Air Quality

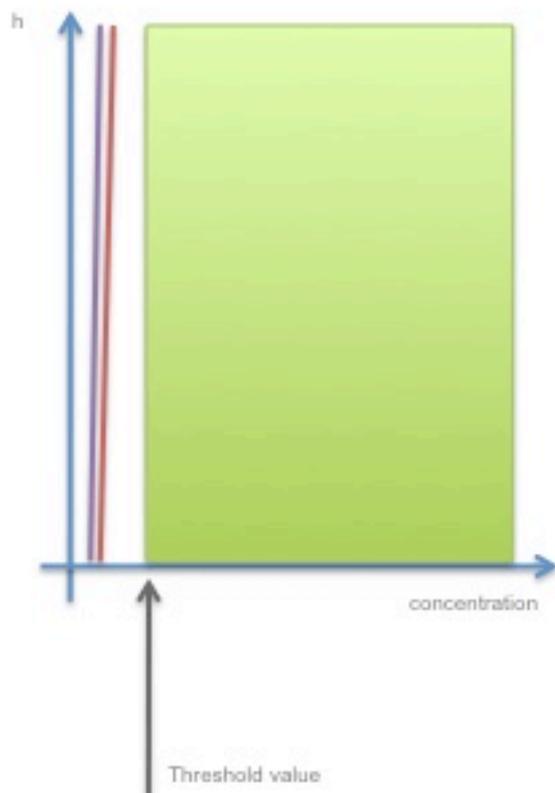


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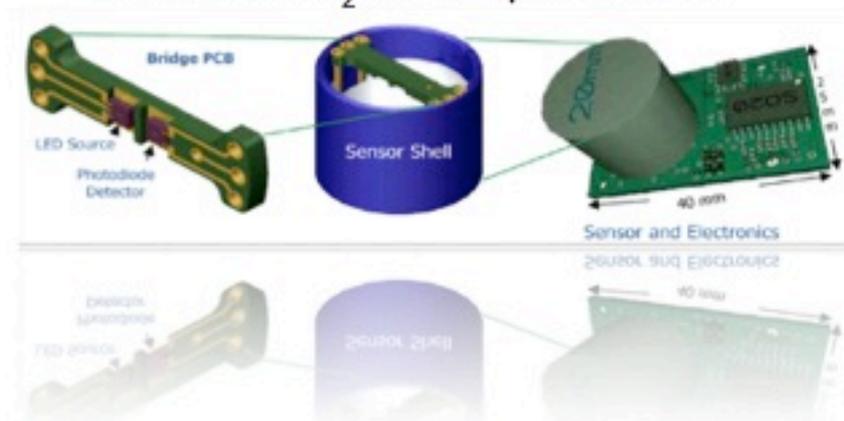


New case study: Business District of Naples



Noise at zero (30s integration)	10 ppm
Temperature range	-25C to +55C
Supply Voltage	4.7V to 5.5V (std) 3.3V to 5.5V (low)
Average Power Consumption	<100mW
Peak Supply Current	200mA
Range	0 to 20% (up to 100% available)
Output	TTL level RS232 + Analogue Output
T90	< 4secs
Zero Drift	Recommend re-zeroing once 2-3month

Led NDIR CO₂ sensor specification





New case study: Business District of Naples



Video 4





New case study: Business District of Naples





Ongoing activities

TIES ENVIRONMETRICS

SOLID WASTE LANDFILLS MONITORING BY AERIAL INFRARED THERMOGRAPHY
M. Lega*, L. Di Biase†, R.M.A. Napoli*

Università degli Studi di Napoli-Parthenope
Dipartimento di Scienze per l'Ambiente
Università di Napoli-Parthenope (Italy)
email: lega@uniparthenope.it

97th INTERNATIONAL CONFERENCE ON ENVIRONMENTAL SCIENCE AND TECHNOLOGY
CEST 2008

AERIAL INFRARED THERMOGRAPHY IN THE SURFACE WATERS CONTAMINATION MONITORING
M. LEGA* and R.M.A. NAPOLI*

Università degli Studi di Napoli-Parthenope
Dipartimento di Scienze per l'Ambiente
Università di Napoli-Parthenope (Italy)
email: lega@uniparthenope.it

Advanced Particulate Matter monitoring using aerial platforms and quartz crystal microbalance
M. Lega*, L. Di Biase†, R.M.A. Napoli*, A. Falgauff*, G. Pappalardo*

with contribution of
PM2008
3rd European Network on Particulate Aerosols
Ambiente, Salute, Scienze e Tecnologie in un'era Globalizzata

Termografia e piattaforma (DAV)TA per il monitoraggio di processi negli impianti di Separazione delle acque reflue
M. Lega*, L. Di Biase†, R.M.A. Napoli*

Università degli Studi di Napoli-Parthenope
Dipartimento di Scienze per l'Ambiente
Università di Napoli-Parthenope (Italy)
email: lega@uniparthenope.it

with contribution of
MIRA, AIR, CIRA, UNIPAR

Università degli Studi di Napoli-Parthenope
FLIR

Giornata studio: la termografia nel settore Ricerca e Sviluppo

La termografia nel monitoraggio ambientale: tecniche avanzate di indagine da piattaforma aerea

Relatore: Prof. Massimiliano LEGA

with contribution of
MIRA, AIR, CIRA, UNIPAR

A new approach to solid waste landfill aerial monitoring
M. Lega*, L. Di Biase†, R.M.A. Napoli*

Università degli Studi di Napoli-Parthenope
Dipartimento di Scienze per l'Ambiente
Università di Napoli-Parthenope (Italy)
email: lega@uniparthenope.it

with contribution of
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